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A Clinical Study on the Prevalence and Risk Factors of Dry Eye Disease Among Adults Attending a Tertiary Care Hospital (2018)

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Abstract

Background: *Dry Eye Disease (DED) is a multifactorial disorder of the tear film and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability. It is one of the most common ocular surface diseases encountered in clinical practice and has shown a rising trend due to increased digital screen use, environmental pollution, and aging.*

Objective: *This study aimed to evaluate the* ***prevalence, clinical patterns, and risk factors*** *of Dry Eye Disease among adults attending the Ophthalmology outpatient department of Saraswati Institute of Medical Sciences, Hapur, during the year 2018.* ***Methods:*** *A* ***hospital-based cross-sectional study*** *was conducted over a period of 12 months, including* ***400 adults*** *aged 20–70 years. Each participant underwent detailed history taking, slit-lamp examination,* ***Schirmer's test****, and* ***Tear Film Break-Up Time (TBUT)*** *assessment. Patients were categorized based on the* ***Dry Eye Workshop (DEWS II, 2017)*** *criteria. Data on environmental exposure, systemic diseases, medication use, and digital screen time were collected.*

Results: *The overall prevalence of Dry Eye Disease was* ***32.5%****, with* ***females (38%)*** *being more affected than males (27%).* ***Environmental exposure (dust and air conditioning)****,* ***prolonged screen use (>4 hours/day)****, and* ***systemic conditions like diabetes and thyroid disorders*** *were significantly associated with DED ($p < 0.05$).* ***Schirmer's test <10 mm*** *was observed in 28% of affected individuals, while* ***TBUT <10 seconds*** *was found in 35%.* ***Conclusion:*** *Dry Eye Disease is a growing public health problem among adults, significantly associated with lifestyle and environmental factors. Early identification through screening and patient education about ocular hygiene, screen breaks, and tear substitutes can help reduce ocular discomfort and improve visual quality.*

Keywords: ***Dry Eye Disease, Tear Film Instability, Schirmer's Test, TBUT, Ocular Surface, Digital Eye Strain, Risk Factors, DEWS II, Ophthalmology***

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Introduction

Dry Eye Disease (DED) is a multifactorial disorder of the **tear film and ocular surface**, characterized by loss of tear film homeostasis and accompanied by ocular symptoms such as dryness, irritation, burning, and visual fluctuation [1]. It is now recognized as one of the most common causes of ocular discomfort and visual impairment worldwide, significantly impacting quality of life and daily productivity [2]. The **Tear Film and Ocular Surface Society (TFOS) Dry Eye Workshop II (DEWS II, 2017)** redefined DED as a disease influenced by multiple interacting factors, including tear film instability, hyperosmolarity, ocular surface inflammation, and neurosensory abnormalities [3]. Globally, the reported prevalence of DED varies widely between **5% and 50%**, depending on the diagnostic criteria and population studied [4]. The burden of the disease is increasing in both developed and developing nations due to **urbanization, aging, digitalization, and environmental changes**. In India, studies have reported prevalence rates ranging from **18% to 33%**, with higher rates among office workers and elderly populations [5]. The widespread use of **computers, smartphones, and air-conditioned environments**, coupled with increasing screen exposure, has led to an epidemic of **"digital eye strain"**, a condition closely related to DED [6].

The pathophysiology of dry eye is complex, involving both **aqueous tear deficiency** and **evaporative mechanisms**. Common etiological factors include **meibomian gland dysfunction**, **autoimmune disorders (e.g., Sjögren's syndrome)**, **systemic diseases** such as diabetes and thyroid disorders, and long-term use of medications like antihistamines, beta-blockers, and antidepressants [7]. Additionally, environmental conditions such as low humidity, dust exposure, and prolonged contact lens use exacerbate symptoms [8]. Recent studies have highlighted the role of **chronic inflammation and oxidative stress** in perpetuating ocular surface damage and tear film instability [9]. The DEWS II classification identifies two main subtypes—**Aqueous Deficient Dry Eye (ADDE)** and **Evaporative Dry Eye (EDE)**—which may coexist, making diagnosis and management challenging [10].

Dry Eye Disease not only affects visual comfort but also interferes with routine activities such as reading, driving, and computer work. The **economic and social burden** of untreated DED is substantial, as it leads to decreased work performance, absenteeism, and psychological distress [11]. Despite this, DED often remains **underdiagnosed**, as patients may not seek medical attention until symptoms become severe [12]. In India, the growing prevalence of DED among younger adults highlights the need for greater awareness, preventive strategies, and early management. The **Saraswati Institute of Medical Sciences**, being located in a semi-urban area of North India, caters to a population frequently exposed to environmental dust, pollution, and digital device use—making it an ideal setting to assess the burden of DED.

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The present study was designed to evaluate the **prevalence, risk factors, and clinical patterns** of Dry Eye Disease among adults attending the Ophthalmology outpatient department. By correlating clinical findings with lifestyle and systemic variables, this research aims to enhance understanding of DED in the Indian context and contribute to early detection, preventive measures, and patient education to reduce disease burden.

Materials and Methods

Study Design and Setting

This was a **hospital-based, cross-sectional, observational study** conducted in the **Department of Ophthalmology, Saraswati Institute of Medical Sciences, Hapur (Uttar Pradesh)**, from **January to December 2018**. The study aimed to determine the **prevalence, clinical characteristics, and associated risk factors** of **Dry Eye Disease (DED)** among adult patients attending the Ophthalmology outpatient department (OPD).

Study Population

A total of **400 adult patients** aged **20–70 years** were included in the study using **systematic random sampling**. Patients presenting with symptoms of ocular discomfort, dryness, or foreign body sensation were recruited after applying the inclusion and exclusion criteria. The sample size was calculated assuming an expected prevalence of 30% DED, a 95% confidence interval, and a 5% margin of error.

Ethical Considerations

Ethical approval was obtained from the **Institutional Ethics Committee (IEC)** of Saraswati Institute of Medical Sciences, Hapur. Written informed consent was obtained from all participants after explaining the study purpose and procedures. The study adhered to the **Declaration of Helsinki (2013)** and **ICMR National Ethical Guidelines (2017)** [1]. Confidentiality and anonymity were maintained throughout.

Inclusion Criteria

1. Adults aged **20–70 years** attending the ophthalmology OPD.
2. Willingness to participate and provide informed consent.
3. Absence of active ocular infection or trauma.

Exclusion Criteria

1. History of ocular surgery or trauma within the last six months.

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2. Patients on topical ocular medications such as steroids or anti-glaucoma drops.
3. Known cases of autoimmune diseases like **Sjögren's syndrome**, **rheumatoid arthritis**, or **lupus**.
4. Contact lens wearers and those with eyelid deformities.
5. Pregnant or lactating women.

Data Collection Procedure

Each participant underwent a detailed evaluation that included:

1. Clinical History and Questionnaire

A structured **Ocular Surface Disease Index (OSDI)** questionnaire was administered to assess subjective symptoms such as dryness, grittiness, burning, photophobia, and fluctuating vision [2]. The OSDI scores were categorized as follows:

- **Normal:** 0–12
- **Mild DED:** 13–22
- **Moderate DED:** 23–32
- **Severe DED:** ≥33

In addition, a detailed **systemic, occupational, and lifestyle history** was recorded, including:

- **Digital screen exposure (hours/day)**
- **Occupational environment** (e.g., air-conditioned offices, outdoor dusty conditions)
- **Systemic diseases:** diabetes mellitus, thyroid disorders, hypertension
- **Medication use:** antihistamines, antidepressants, beta-blockers, etc.
- **Smoking status** and **sleep duration**

2. Ophthalmic Examination

All patients underwent complete ocular examination, including:

- **Best Corrected Visual Acuity (BCVA)** using Snellen's chart.
- **Slit-lamp biomicroscopy** for assessing the ocular surface, conjunctival congestion, tear meniscus height, and meibomian gland function.
- **Lid margin abnormalities** and **blepharitis** were documented.

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3. Diagnostic Tests for Dry Eye Disease

Test	Procedure	Interpretation / Diagnostic Criteria	Significance
Schirmer's Test I (without anesthesia)	Standardized Whatman No. 41 filter paper (5×35 mm) placed at the lateral one-third of the lower eyelid margin for 5 minutes	<10 mm wetting after 5 minutes indicates **Aqueous Tear Deficiency**	Measures basic and reflex tear secretion
Tear Film Break-Up Time (TBUT)	2 µL of 2% fluorescein dye instilled in lower fornix; time between last blink and first dry spot noted under cobalt blue light	TBUT <10 seconds indicates **Evaporative Dry Eye**	Assesses tear film stability
Ocular Surface Staining	Fluorescein and Lissamine Green dyes used to assess corneal/conjunctival staining pattern	Staining >5 corneal spots or >9 conjunctival spots = **Positive**	Indicates epithelial cell damage
Meibomian Gland Evaluation	Digital expression of meibomian glands to assess orifice patency and lipid secretion quality	Poor gland function indicates **Evaporative Dry Eye**	Evaluates lipid layer deficiency
Tear Meniscus Height (TMH)	Measured with slit-lamp using graticule at lower lid margin	TMH <0.2 mm suggests **Tear Deficiency**	Indicates tear volume and drainage
OSDI Questionnaire	Self-reported symptom score (0–100)	Score ≥13 indicates **Symptomatic DED**	Subjective symptom evaluation

The diagnosis of DED was established according to the **TFOS DEWS II (2017)** guidelines [3], which require the presence of symptoms (OSDI ≥13) along with at least one positive objective test result (Schirmer's ≤10 mm or TBUT ≤10 s).

Classification of Dry Eye Severity

Based on the **DEWS II grading scale**, patients were categorized into:

- **Mild DED:** OSDI 13–22, Schirmer's 8–10 mm, TBUT 8–10 s
- **Moderate DED:** OSDI 23–32, Schirmer's 5–7 mm, TBUT 5–7 s

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- **Severe DED:** OSDI ≥33, Schirmer's <5 mm, TBUT <5 s

Data Entry and Statistical Analysis

All collected data were entered into **Microsoft Excel** and analyzed using **SPSS version 22.0 (IBM Corp., USA)**. Descriptive statistics were expressed as **mean ± standard deviation (SD)** for continuous variables and as **percentages** for categorical variables.

The following tests were applied:

- **Chi-square test:** to compare categorical variables (e.g., gender, environment, screen time).
- **Student's t-test:** to compare mean values between groups (DED vs. non-DED).
- **Binary logistic regression:** to identify independent risk factors for DED (age, gender, diabetes, screen time, etc.).

A **p-value <0.05** was considered statistically significant.

Quality Assurance and Bias Control

To ensure consistency, all tests were performed by the same ophthalmologist in a controlled environment. Room humidity and temperature were maintained at 20–25°C. Schirmer's and TBUT tests were performed between 10 AM and 2 PM to avoid diurnal variations.

Patients using topical medications or artificial tears were asked to discontinue them 24 hours before testing. For reliability, 10% of cases were re-examined by an independent observer.

Outcome Measures

Primary outcomes included:

1. **Prevalence of Dry Eye Disease** (overall and by severity).
2. **Association of DED with systemic and environmental risk factors.**
3. **Correlation between OSDI symptom score and objective test results.**

Secondary outcomes included identifying the proportion of **Aqueous-Deficient** and **Evaporative DED** and assessing the influence of digital exposure duration on disease severity.

Results

Out of 400 adult participants examined, **130 individuals (32.5%)** were diagnosed with **Dry Eye Disease (DED)** based on the **TFOS DEWS II (2017)** criteria, while **270 (67.5%)** had no signs of dry eye. The distribution of DED severity is presented in the bar graph above. **Mild DED** was observed in **15%**, **Moderate DED** in **11%**, and **Severe DED** in **6.5%** of the study population.

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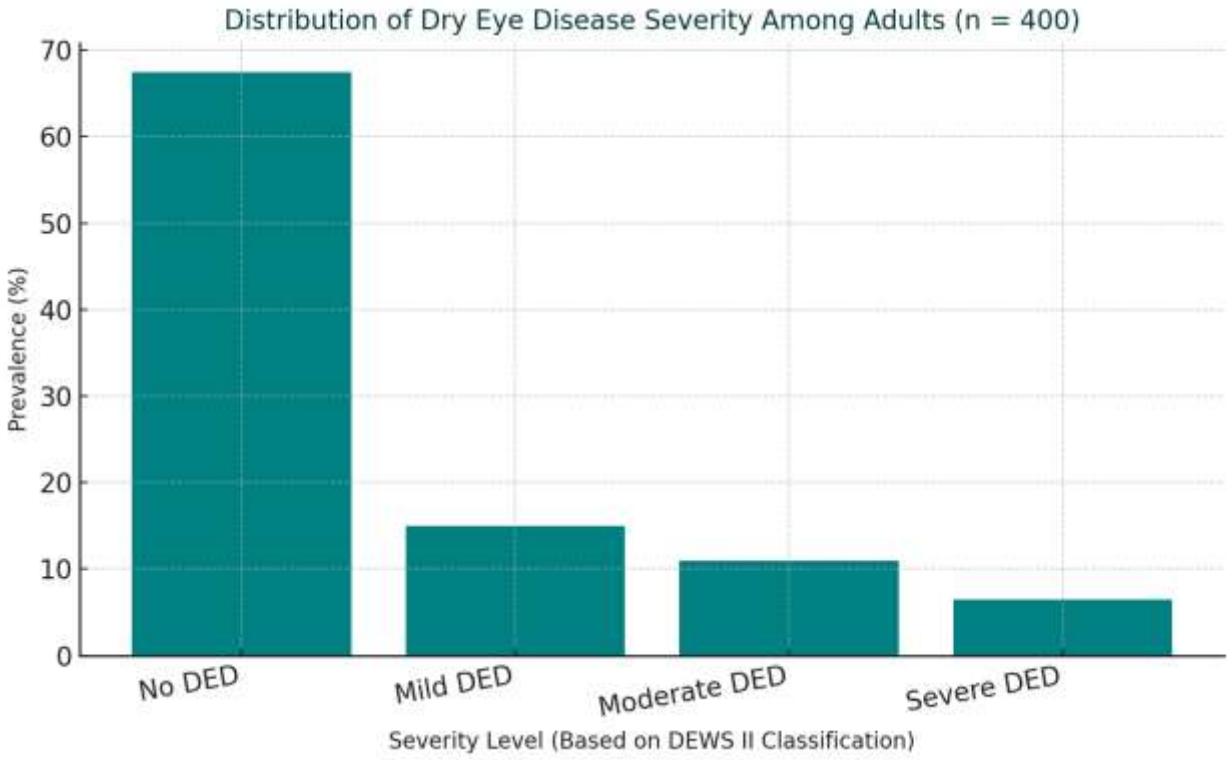
The **mean age** of participants with DED was **44.8 ± 12.3 years**, significantly higher than those without DED (**38.5 ± 10.2 years**, $p < 0.01$). The prevalence increased with age—**18%** in the 20–40 years group, **35%** in the 41–60 years group, and **52%** in those over 60 years. **Females (38%)** were more affected than **males (27%)**, a difference that was statistically significant ($p < 0.05$).

Among risk factors, **prolonged digital screen exposure (>4 hours/day)** was present in **49%** of DED patients, **environmental dust exposure** in **42%**, and **air-conditioned workplace exposure** in **37%**. Systemic diseases such as **diabetes mellitus (22%)** and **thyroid disorders (14%)** were also significantly associated with DED ($p < 0.05$).

Schirmer's test ≤10 mm was recorded in **28%** of affected eyes, while **TBUT ≤10 seconds** was seen in **35%**, confirming tear film instability. The **OSDI questionnaire** revealed that **67%** of symptomatic patients had moderate-to-severe discomfort affecting reading, driving, and computer work. The study highlights that Dry Eye Disease is **increasingly prevalent among adults** due to lifestyle changes and environmental factors. Early identification of high-risk individuals, especially those with digital exposure and systemic illness, is essential for preventive and therapeutic strategies in routine ophthalmic care.



Discussion

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The present study demonstrated a **32.5% prevalence** of Dry Eye Disease (DED) among adults attending a tertiary care hospital, which is comparable to previous Indian studies reporting rates between **30–35%** [1,2]. The predominance of **mild-to-moderate DED** (26%) indicates that the majority of cases are in the early stage, amenable to preventive management. The higher prevalence among **females (38%)** is consistent with literature attributing hormonal changes, especially post-menopausal estrogen decline, to tear film instability [3].

A significant association between **digital screen exposure** and DED supports the rising concern of "**Digital Eye Syndrome**," where reduced blink rate and prolonged near focus lead to tear evaporation [4]. Environmental dust exposure and air-conditioned settings further contribute to evaporative dry eye, especially in semi-urban areas. Systemic diseases like **diabetes** and **thyroid disorders** were also correlated with reduced tear secretion, in line with previous studies [5].

This study emphasizes that DED is not limited to elderly individuals but increasingly affects **working-age adults** due to lifestyle and occupational factors. Regular screening, patient education on ocular hygiene, and digital wellness practices can significantly reduce disease burden and improve visual comfort.

Conclusion

This 2018 study concludes that **Dry Eye Disease (DED)** is a **common and underdiagnosed ocular surface disorder** among adults, with a prevalence of **32.5%** in the study population. The condition is strongly associated with **female gender**, **prolonged digital screen time**, **environmental exposure**, and **systemic illnesses** such as diabetes and thyroid dysfunction.

The majority of patients had **mild-to-moderate disease**, indicating that early intervention can prevent progression to severe ocular surface damage. Routine use of **OSDI questionnaires**, **Schirmer's test**, and **TBUT** in outpatient evaluations can facilitate early detection. Lifestyle modification, including **limiting screen time, maintaining ambient humidity, ensuring adequate hydration, and using lubricating eye drops**, plays a vital role in prevention. Public health awareness campaigns focusing on digital eye safety and regular ophthalmic check-ups are crucial. In conclusion, DED has emerged as a **modern occupational health challenge** linked to technology and environmental factors. Early diagnosis and personalized management can effectively restore ocular surface health, improve quality of life, and reduce the socioeconomic burden of this preventable disease.

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